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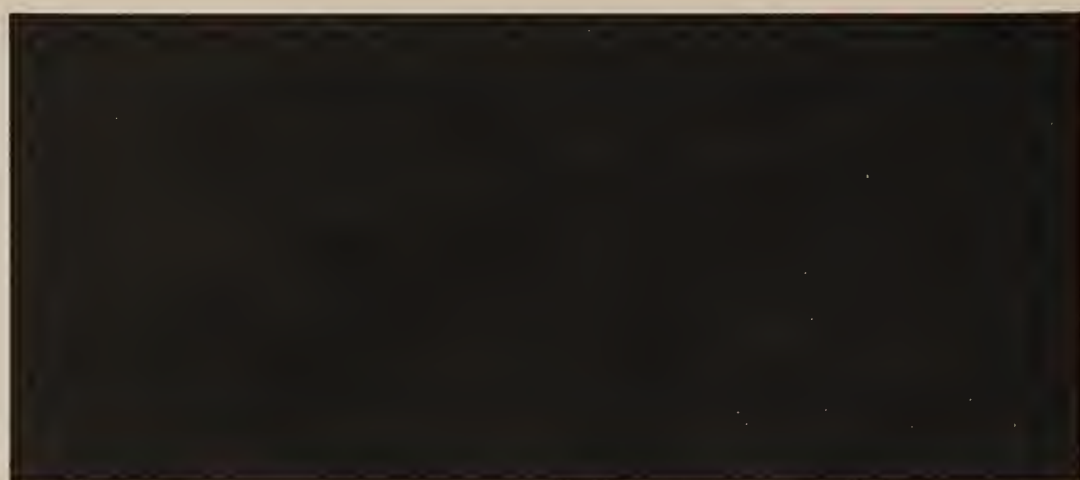
RESEARCH PROPOSAL  
to  
Montana Highway Commission and  
Bureau of Public Roads  
To Extend the Drainage Correlation  
Research Project to June 30, 1970

# ENGINEERING

## Research Laboratories

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PROPOSAL  
1970

MONTANA STATE UNIVERSITY, BOZEMAN






PROJECT #CE 66-9  
(Extension 604)


RESEARCH PROPOSAL  
to  
Montana Highway Commission and  
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To Extend the Drainage Correlation  
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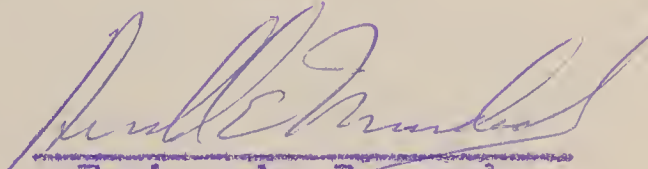
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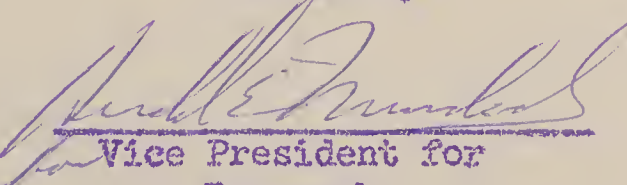
Submitted to  
Paul R. DeVine  
Planning Survey Director  
Montana State Highway Department  
Helena, Montana

  
Project Supervisor

  
Coordinator

  
Acting Head of Department

  
Engineering Research  
Laboratory

  
Vice President for  
Research

July 1, 1966

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PROPOSAL TO EXTEND THE  
DRAINAGE CORRELATION RESEARCH PROJECT TO  
June 30, 1970

INTRODUCTION

The Drainage Correlation Research Project, which has been in operation since June 15, 1963, is currently scheduled for completion on June 30, 1967. Data collection on four instrumented watersheds is scheduled to be terminated on September 30, 1966.

Data analysis has proceeded to the point where it has become evident that the 3 years of precipitation and runoff data, and the 2 years of meteorological data which have been collected, are inadequate for making satisfactory determinations of flood frequency relationships.

TIME EXTENSION REQUEST

It is requested that the project be extended three additional years, to June 30, 1970.

It is proposed that Phase I of the project (Correlation of Precipitation Data collected by the U. S. Weather Bureau with peak flow data on small watersheds) be terminated as presently scheduled, on June 30, 1967, and that a final report be prepared by that date covering the findings.

It is proposed that Phase II of the project (comprehensive hydrologic studies of four watersheds) be extended, with collection and analysis of data from the presently installed instruments to continue through September 30, 1969. It is anticipated that interim reports presenting findings to date for Bacon Creek, Hump Creek, and Duck Creek (similar to the May 1966 Interim Report #4 for Lone Man Coulee) would be prepared by June 30, 1967, and that further reports would be made after that date as conditions warrant. It is anticipated that all data collected would be analyzed and considered prior to preparation of the final report.

JUSTIFICATION FOR EXTENSION

Results obtained to date from the project are encouraging, and show promise of yielding much useful information from which design criteria for hydraulic structures can be formulated. Several significant runoff events have occurred on some of the instrumented watersheds. The records that are available, however, are too short to have much statistical significance, and it is believed that an additional three years of study will greatly enhance the value of the investigation.



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The capital expenditure for instrumentation of the watersheds to date is nearly \$ 20,000. The actual worth of the investment, however, is substantially larger, for two reasons. First, the Electronics Research Laboratory at M.S.U., which developed and assembled the Weather Station instrumentation, absorbed and subsidized much of the development expense. Second, installation was expedited by use of equipment that would normally have been available only at a much greater expense. Early problems that were encountered in connection with servicing and maintaining the equipment have now been largely overcome.

If the project is granted an extension, two alternatives now appear.

The first alternative would be to continue operation of the project with the instrumentation essentially as it is now. The only capital expenditure proposed would be to modify the cabinets housing the electronic gear and recorders for the weather stations, to improve reliability and to simplify the chart-changing operation. A large share of the additional funds requested would be for reduction and analysis of data. An advantage of this alternative would be the providing of part-time employment for several undergraduate students, who would be utilized primarily for reduction of data. Some of the students who have been employed by this project during the past three years would have been unable to stay in school for financial reasons, had it not been for the job opportunities the project afforded them.

The second alternative would be to modify the recording units on the 8 weather stations to provide output which could be fed directly into the IBM 1620-2 computer for reduction. Engineers at the Electronics Research Laboratory at M.S.U. are exploring different ways in which this could be accomplished, and have reached a firm cost figure. A new recorder would be required at each of the 8 weather stations, plus a central converter at Bozeman to convert the recorder output into punch cards or perforated tape. The converter would be suitable for use with many more than 8 weather stations, should it ever be desirable to expand the study. An advantage of this alternative would be the more rapid availability of reduced data. The computer could perform a considerable amount of data analysis simultaneously with the data reduction operation. This alternative would require a larger capital expenditure, and additional computer costs, but these expenditures would be partly offset by reduced labor costs. Over an extended period of time this alternative would be cheaper because of the labor savings.





## BUDGET

The project currently is funded under a total budget of \$ 105,200. As of June 1966 about \$ 21,000 in unexpended funds remain. These funds should be adequate to complete the project if it should be terminated on June 30, 1967. The original budget, however, anticipated cessation of data collection on September 30, 1966. If the project is to be extended, some of the unexpended funds will need to be used for data collection after the September 30, 1966 date. This would mean that the presently budgeted funds would be exhausted short of June 30, 1967, perhaps by March 1967. If Alternative 2 should be adopted, a large expenditure for capital would be made, probably early in 1967.

On August 25, 1965, it was estimated that \$ 25,000 would be spent in the calendar year 1966. It now appears that if the proposed extension is granted, the earlier estimate of 1965 expenditures will be low by about \$ 6,000.

The additional budget which is proposed on the following page is requested, to provide funding through June 30, 1970, with data collection to continue through September 30, 1969. Two Alternative Budgets, Alternatives 1 and 2, are shown, corresponding to the two alternatives discussed above.



# ALTERNATE A

## Additional Funds Requested:

1. Salaries and Wages		
Staff: 0.5 FTE per year for 3 years	\$18,000.	
@ \$12,000 per year		
Graduate Students: 1 @ \$4500 per	9,000.	
year for 2 years		
Student Labor: \$6,000 per year	18,000.	
Total Salaries and Wages		\$45,000.
Retirement and Insurance (8%)		3,600.
2. Travel @ \$1,500 per year		4,500.
3. Supplies @ \$1,000 per year		3,000.
4. Clerical and Reports		1,000.
TOTAL DIRECT		\$57,100.
5. Overhead at 30%		17,130.
6. Capital: Modifications to present instrumentation		8,700.
7. Data Collection: Payments to Observers, 3 years @ \$1,500.		4,500.
8. Computer Charges		2,000.
9. U.S.G.S. for Servicing Equipment		2,500.
10. Snow Surveys		2,000.
11. Aerial Flights		3,000.
TOTAL ADDITIONAL BUDGET REQUESTED		\$96,930.

# ALTERNATE B

## Additional Funds Requested:

1. Salaries and Wages		
Staff: 0.5 FTE per year for 3 years	\$18,000.	
@ \$12,000 per year		
Graduate Students: 1 @ \$4,500 per	9,000.	
year for 2 years		
Student Labor: \$3,000 per year	9,000.	
Total Salaries and Wages		\$36,000.
Retirement and Insurance (8%)		2,880.
2. Travel @ \$1,500 per year		4,500.
3. Supplies @ \$1,000 per year		3,000.
4. Clerical and Reports		1,000.
TOTAL DIRECT		\$47,380.
5. Overhead @ 30%		14,220.
6. Capital: Modifications to present instrumentation		25,000.
(including automation of data collection)		
7. Data Collection: Payments to observers, 3 years @ \$1,500		4,500.
8. Computer Charges		4,000.
9. U.S.G.S. for Servicing Equipment		2,500.
10. Snow Surveys		2,000.
11. Aerial Flights		3,000.
TOTAL ADDITIONAL BUDGET REQUESTED		\$102,600.

NOTE: Actual indirect costs are subject to audit in accord with Bureau of Budget Circular A21.



1. The first part of the paper discusses the importance of maintaining accurate records of all transactions. It emphasizes that proper record-keeping is essential for the success of any business or organization. The author provides a detailed explanation of the various methods used to collect and analyze data, highlighting the importance of consistency and accuracy in the process.

2. The second part of the paper focuses on the challenges faced by researchers in this field. It discusses the difficulties of obtaining reliable data, the limitations of existing methods, and the need for innovative approaches to overcome these obstacles. The author also addresses the ethical considerations involved in the collection and use of data, emphasizing the importance of transparency and accountability.

3. The third part of the paper presents the results of a series of experiments conducted to evaluate the effectiveness of different data collection methods. The author compares the results of various techniques, including surveys, interviews, and observations, and discusses the strengths and weaknesses of each. The findings suggest that a combination of methods is often the most effective way to gather accurate and reliable data.

4. The fourth part of the paper discusses the implications of the research findings for practice. It provides recommendations for how researchers and practitioners can improve their data collection and analysis processes, and discusses the potential for future research in this area. The author concludes by emphasizing the importance of ongoing research and innovation in the field of data collection and analysis.



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